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Policy Forum Article

Three Pillars of Fisheries Policy

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Abstract

The causes of overfishing are reviewed along with deficiencies in top-down input-regulated fisheries management. An alternative is the three pillars of fisheries policy intended to ensure sustainable, economically viable fisheries and marine ecosystems. The first pillar are incentives that promote a long-term interest in both fisheries and marine ecosystems; the second are targets that account for the bioeconomics of fisheries; and the third, adaptive management practices, especially marine protected areas, that promote resilience against ecosystem disturbances. Collectively, the three pillars offer a practical and proven combination to 'turn the tide' and help overcome the overexploitation prevalent in many of the world's marine capture fisheries.

Key words: overfishing, incentives, maximum economic yield, marine protected areas, resilience

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1. Introduction

There are many regional and historical examples of fisheries that have been overexploited and mismanaged. One of the best known is the collapse of the Northern Cod Fishery on the eastern coast of Canada, off Newfoundland. In 1992, a moratorium on fishing was declared as a result of a dramatic collapse in the stock attributable to overharvesting and simply 'too many vessels, chasing too few fish' (Grafton et al. 2000). This fishery had previously generated an annual catch of about 200,000 tons for at least a century, but beginning in the 1960s and in the absence of any territorial control or limit on fishing, catches peaked in 1968 at over 800,000 tons.

Extended jurisdiction by Canada out to 200 nautical miles in 1977 allowed for the exploitable biomass to recover and to more than double between 1977 and 1984 as foreign fleets lost access to many of the fishing grounds. Nevertheless, Canadian jurisdiction also had a downside because the Canadian government subsidised the domestic fishing industry to expand to take advantage of the extended control of its continental shelf. This, in turn, helped to increase harvests by more than 50 per cent with a peak of 269,000 tons in 1988. Unfortunately, this harvest level was unsustainable and equivalent to about 40 per cent of the total exploitable biomass—and a[1]n exploitation rate even higher than in the late1960s when foreign fleets caught most of total catch.

A direct consequence of this overexploitation was that the northern cod stocks collapsed to about 1 per cent of their previous levels. Twenty years later, stocks have still failed to recover and remained at very low quantities compared with their historic levels. Very slow rates of recovery, as with the Northern Cod Fishery, is a common feature of fisheries that become depleted to very low biomass levels (Hutchings & Reynolds 2004). A litany of failures that included subsidies to fishers, poor measurement of the size of the cod stocks, delays in reducing the allowable catch as stock declined and technical change that increased the fishing power of vessels due to improvements in fishing technology all contributed to the demise of what was once one of the world's largest fisheries.

Overfishing arises from inadequate information, management approaches that are fragile to unanticipated shocks or disturbances, an inability to respond quickly and effectively to stock declines, and inappropriate incentives for fishers that encourage them to act in ways that are contrary to the long-term interest of the fishery and their industry. Overlaying these information, response and incentives failures, financial support in the form of research and management expenditures and transfers to fishers that amount to multiple of billions of dollars per year (Organisation for Economic Co-Operation and Development 2006) have exacerbated the problem of overfishing and effort creep. A way forward is to adopt three pillars of fisheries policy: one, generate long-term incentives in fisheries and marine ecosystems; two, specify quantitative biological and economic targets that account for fishers and fish; and three, undertake actions that promote ecosystem and fisheries resilience and 'bounce back' to negative shocks and disturbances. This has special implications for fisheries in the Pacific region, especially the western and central Pacific tuna fishery (Kompas et al. 2010).

2. Causes of Overfishing

Fisheries share two features that contribute to overfishing. First, the catch of one fisher makes less available for harvest by others. Consequently, there is an in-built incentive to 'race to fish' to ensure a desired harvest before someone else catches the available fish. This race is magnified when there are overall harvest or effort controls, but no individual limits or controls. Second, marine fisheries are prosecuted at sea and this makes it difficult, and often expensive, to monitor what is caught, where fish are harvested, by whom and when. The challenges of effective monitoring has resulted in misreporting and also fish practices that may be detrimental to both targeted and non-targeted species—a problem made much more difficult in the high seas and for highly migratory fisheries (Metuzals et al. 2010).

The lack of property rights in fisheries has allowed fishers to either freely enter a fishery (open access), or if the number of vessels is controlled (limited-user open access), to make investments on their vessels and adopt new technologies that increase the effective fishing effort over time, even when nominal fishing effort is regulated. As in the case of the Northern Cod Fishery, open access in the 1960s led to gross overfishing, but even with regulated access and controls of the total harvest implemented in the 1980s during Canadian jurisdiction, the same unsustainably higher levels of exploitation continued (Grafton et al. 2000). In another example of top-down controls, the Australian Northern Prawn Fishery was managed for decades with a series of input controls designed to limit fishing power. All these approaches encouraged fishers to substitute to unregulated and less efficient inputs. This, in turn, reduced the net returns to fishers, lowered efficiency and resulted in even greater fishing effort that the input regulations were intended to halt (Kompas et al. 2004).

In many fisheries, the focus of management is on achieving a given fishing mortality, typically implemented through a total allowable catch or harvest limit or via indirect controls on fishing inputs. This is a top-down approach that fails to respond to the incentive of fishers to increase their fishing effort. In many cases, regulators respond to this effort creep by imposing further reductions in the overall harvest or additional input restrictions. This is the case of 'shut the barn door after the horse has bolted' and may even provide a further boost to race to fish because there remains an ongoing incentive for fishers to substitute to unregulated inputs (Squires 1987), or when the overall catch is reduced, fishers have an added incentive to catch their desired harvest at an even quicker rate.

Fisheries management that focuses on the inputs used by fishers, rather than on their actions and motivations, has frequently led to adverse outcomes. For example, perverse incentives and inadequate and overly complex governance are given as the principal reasons for overfishing of bottom-dwelling fish species in the North Atlantic (Maguire 2003), and has resulted in fishers in Europe, North America and Australia lobbying regulators not to reduce the total allowable catch. This is because in the absence of appropriate incentives, rights and responsibilities, a reduction in the current harvest level so as to conserve or grow the fish stock is not offset by a corresponding gain from a future, sustainable fishery. Instead, with top-down regulations, should stocks recover, fishers would still need to outcompete fellow fishers with little surety of receiving actual, future benefits from conservation actions undertaken today.

3. First Pillar: Incentive-based Fisheries Management

By contrast to top-down regulations that focus on overall fishery controls and often run counter to fishers' interests, bottom-up incentive-based approaches seek to align individual incentives with the public good. One of the keys to aligning individual with collective incentives is to provide fishers with harvest shares or territorial use rights that allow them to enjoy the long-term benefits of conservation and incur the costs of overfishing. Better incentives and practices arise because fishers, or their communities, are allocated a fixed share of the harvest or a territorial area that will allow them to benefit from increases in the stock level and the overall catch. These approaches have been implemented in several countries and have reduced costs of fishing, improved efficiency (Grafton et al. 2000), helped to raise fisher returns and, in a number of fisheries, promoted more sustainable fishing practices (Grafton et al. 1996). Evidence from at least a dozen fisheries worldwide indicate that incentive-based approaches that involve either individual or community harvesting and/or territorial rights, as well as the pricing of ecosystem services, can promote sustainable fisheries (Hannesson 2004; Grafton et al. 2006a).

Incentives that promote sustainability, including reductions in the harvest of by-catch (Gilman & Lundin 2010), can arise from secure and transferable rights for catch shares of the allowable catch or effort. Community rights, if allocated to a sufficiently cohesive and small enough number, can facilitate collective action and coordination, improve monitoring and compliance, and can also generate conservation incentives. Secure and durable harvesting shares or territorial rights give fishers a long-term stake or interest in the fishery beyond the current fishing season. This can encourage conservation behaviour, and not just for target species, and promotes bottom-up decision-making and greater fisher involvement in management decisions (McIlgorm & Sykes 2010).

Stakeholder engagement does not, by itself, guarantee better management decisions, but there are numerous examples where fishers have paid themselves for improved monitoring, increased research and also voluntarily changed previously harmful fishing practices (Grafton et al. 2006a; McIlgorm & Sykes 2010). In a global study, Costello et al. (2008) showed the sustainability benefits of getting the incentives right for fishers. Using the counterfactual that *if* individual fishers had been given defined catch shares in 1970, only 9 per cent of fisheries would have suffered reductions in catches that were10 per cent or less of their historic maximum, and would not have declined thereafter, versus the 28 per cent that did suffer this fate.

4. Second Pillar: Dynamic Maximum Economic Yield as a Management Target

Fisheries managers have almost exclusively adopted biological targets or goals such as maximising the sustained yield from a fishery, commonly defined as B_{MSY}. In some cases, managers have had a target stock level slightly larger than B_{MSY} so as to provide a buffer should stock levels be badly measured or to allow for resilience to unexpected shocks that may reduce fish populations. An alternative biological and economic target is dynamic B_{MEY} that maximises the discounted net surplus from harvesting and processing fish (Grafton et al. 2011) and would apply whether or not the fishery is owned by the state or fishers directly.

Differences in goals and targets, in part, explain differences in fishery outcomes (Hilborn 2007). To be effective, a dynamic B_{MEY} as a target and benchmark should be included as part of governance system that explicitly accounts for uncertainty and unanticipated shocks and considers accountability, transparency, incentives, risk assessment and management, and adaptability (Grafton et al. 2007) as key management performance criteria. This dynamic B_{MEY} target seeks to maximise the discounted net economic returns from the fishery.

Setting a dynamic B_{MEY} as a target does not mean that economic considerations are paramount to conservation objectives because reference targets should also be used to ensure fish stocks are at levels that do not compromise sustainability. Such an approach has already been implemented in Australian Commonwealth fisheries where dynamic B_{MEY} is adopted as the management target (Kompas et al. 2010). A dynamic B_{MEY} target also does not imply that fisheries with low rates of growth, and at rates less than the prevailing rate of interest, should be depleted. This is because Grafton et al. (2010a) show that dynamic B_{MEY} can exceed B_{MSY} even when the growth rate exceeds the discount rate and also demonstrate for a very long-lived fish species (for example, orange roughy) that dynamic B_{MEY} exceeds B_{MSY} at a discount rate in excess of 15 per cent (Grafton et al. 2010b). More generally, whenever dynamic B_{MEY} exceeds both B_{MSY} and the current stock level, there is double payoff, namely it increases the size of the fish stock, raises the long-term profitability of the fishery and also gives additional 'buffer' in the case of adverse shocks or poorly measured stock levels.

A difficulty with any stock target, including dynamic B_{MEY}, is to implement it with less than adequate data in terms of both catches and stock levels (Grafton et al. 2011). Another challenge is technological change that reduces cost per unit of fishing effort that reduces the incentive to maintain higher stock levels (Grafton et al. 2010a). This may result in dynamic B_{MEY} at less than B_{MSY} (Squires & Vestergaard 2013), although such a target must account for sustainability goals and the need to maintain a minimum viable population and be applied with appropriate harvest control rules (Punt 2010).

5. Third Pillar: Actions that Promote Resilience

Uncertainty refers to situations where future outcomes are not known with certainty, and, at best, managers have only subjective probabilities about possible outcomes. It is of paramount importance in fisheries because many marine populations are subject to very large temporal variations even in the absence of fishing pressure. In the context of fisheries, management the choice of whether to use harvest or catch controls versus input or effort controls is, in part, a function of the uncertainty. A framework has been developed to make this choice and when applied to the Northern Prawn Fishery of Australia showed that the total catch controls result in higher total profits, lower variance of expected profits and higher stock levels than effort controls (Kompas et al. 2009).

A valuable approach to cope with uncertainty and unexpected disturbances in fish populations is to establish marine protected areas (MPAs). This generates benefits in terms of habitat protection from reduced harvesting and can protect vulnerable classes of fish as well as providing biodiversity and other conservation benefits. MPAs also provide resilience to disturbances and direct benefits to fishers where populations are subject to random fluctuations. This is because MPAs can act as a buffer when a shock occurs and allow for the transfer of fish from a higher density environment within a reserve to a low-density environment in the fishing zone. This fish transfer, following a negative shock to the fishery, can generate substantial benefit to fishers immediately following such a shock. Such fisher benefits and also the optimal size of a MPA increase with the magnitude of the negative shock (Grafton et al. 2006b). The tradeoff, at least for commercial fishers, is that they incur a lower harvest in the absence of negative shock (Grafton et al. 2005). Using data from the Northern Cod Fishery, Grafton et al. (2009) present a counterfactual and show that *if* an optimal-sized reserve had been established, it would have prevented its collapse in the early 1990s, increased fisher profits and allowed for quicker recovery of the stock.

6. Conclusions

Fisheries policies have frequently failed to prevent overfishing because of inadequate management targets, regulations that fail to consider fisher incentives and actions that are not robust to unexpected shocks or disturbances. An alternative is policy that quantifies bioeconomic targets, utilises incentive-based approaches that provide fishers with long-term incentives, rights and responsibilities in fisheries, and management approaches that allow fisheries to 'bounce back' following an adverse shock. Collectively, the three pillars of bioeconomic targets, incentive-based management and actions that promote resilience can generate a triple payoff: higher fisher profits and greater efficiency, more resilient and larger fishery populations, and improved marine ecosystem services.

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